Title: Integral Green function representations of electromagnetic interferometry with applications for ground penetrating radar

Authors: Evert Slob, Deyan Draganov and Kees Wapenaar (Delft University, The Netherlands)

We present electromagnetic Green function representations for radar wave interferometry in open systems. First we use the known configuration with two passive recording stations inside a volume with equivalent boundary sources present on the closed boundary surface. For this configuration we derive representations for the real part of the electric field Green's function due to a source of the electric current type.

We introduce a new configuration where one passive recording station is inside the domain, while the other is outside this domain. For this configuration we derive representations for the Green's function itself. For this new configuration we extend the notion of interferometry to include correlation of a signal with a time-reversed signal, which is expressed by a time convolution. For this time convolution type of interferometry we derive representations for the Green's function itself. The major advantage of convolution over correlation type interferometry is that it is exact for media with relaxation and/or loss mechanisms. Consequentially, it is also valid and exact for fields where the wave energy is assumed to be zero, like difussive fields, potential fields and stationary flow fields.

For these three basic exact representations we investigate their practical applicability in ground penetrating radar explorations. We investigate the effects of the necessary simplifications introduced and the effects of electric conduction losses on the correlation type of interferometry.